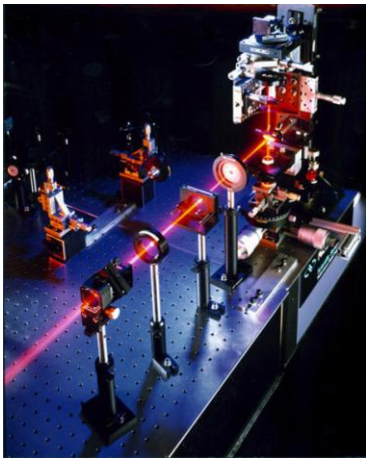
NAWCWD Quick Facts
China Lake & Point Mugu, CA NAVAIR

# Lauritsen Laboratory

*(Labs Include Multi-Sensor Fusion, Multi-Mode Sensor Seeker, Sensor Technology Integration and Evaluation, Targeting, and Optics and Laser Research, Electronics Development, And Proximity Fuze and Sensors)*



**Mission.** Lauritsen Laboratory opened in 1976 and features a 56,000 square-foot structure that incorporates special features in three well-equipped wings with a focus on laser and optical work. Specialized facilities include an 8-by100-foot room designed for optical experiments; a rooftop facility provided for outdoor tests to the horizon; and provisions for lasing from inside the building to a 500-meter eye-safe outdoor laser test range. Today, numerous major labs encompass much of the work.

- **Multi-Sensor Fusion Laboratory (MSFL).** Develops and tests algorithms for combining information from multiple sensors to produce actionable intelligence for targeting and fire control.
- **Multi-Mode Sensor Seeker Laboratory (MMSSL).** Develops and evaluates Laser Radar (LADAR) and Automatic and Aided Target Recognition (AiTR).
- **Sensor Technology Integration and Evaluation Laboratory (STIEL).** Assembles and integrates large EO/IR and eye safe laser systems whose performance is evaluated before flight testing.
- **Targeting Laboratory.** Secured area for classified processing of radar data.
- **Optics and Laser Research Facility.** Designs, fabricates, characterizes, and conducts RDT&E on optical materials, components, systems and subsystems.
- **Electronics Development Laboratory.** Designs and develops prototype electronics for weapons systems, signal processing, interfacing, and data acquisition.
- **Proximity Fuze and Sensors Laboratory (PFSL).** Designs, develops, and provides acquisition, production, and full life cycle support for Naval proximity fuze systems and other short range sensor technologies.

**Unique Features**

- **MSFL.** As the Distributed Ground-Sensor-Grid Threat Detection System (DGTDS) program evolved, this lab has been used to continue refining the correlation algorithms, and preparing for the end to end demonstration of DGTDS. The MSFL also includes a unique mobile sensor fusion tool known as the Vehicle Integrated Sensor Suite for Targeting Applications (VISSTA) that may be integrated with various imaging sensors to develop and demonstrate sensor fusion algorithms and in-the-field processing.
- **MMSSL.** Only laboratory of its kind in NAVAIR, and one of only a few in the DoD dedicated to developing LADAR Automatic Target Recognition (ATR).
- **STIEL.** 1,100 square foot lab with 20’ high ceiling is equipped with 28VDC, 3 phase 208 volt 400 cycle, and 110 volt power, high pressure air, and a high bay access door. Six work benches used for assembly and test.
- **Targeting Laboratory.** It is the only facility of this size in NAVAIR for exclusively processing classified radar data.
- **Optics and Laser Research Facility.** Characterization of optics and materials to include reflectometry, transmission, absorption of coatings (surface) & bulk materials, and total integrated scatter. Unique equipment to provide absolute reflectometry measurements in the infrared regime. The design of simple to complex optical trains become reality with in-house optic fabrication using computer numerically controlled and single point diamond turning equipment.
- **Electronics Development Laboratory.** Quick turn design and prototype electronics, which includes small scale production.
- **Proximity Fuze and Sensors Laboratory (PFSL).** Only laboratory of its kind in NAVAIR and one of only three in the DoD dedicated to proximity fuze and short range sensor systems.

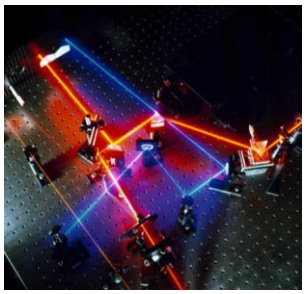
**Cost / Time Savings**

- **MSFL.** In the case of DGTDS the original algorithms were developed to provide an almost instantaneous track on a boosting missile to allow time for deploying effective countermeasures. This lab is used to tailor the algorithms to trade off speed of response for accuracy, or evaluate multiple tracks of boosting missiles to determine which constitutes the most critical threat to the targeted aircraft.
- **MMSSL.** The reason NAWCWD has elected to perform the AiTR in-house is so the government owns the AiTR algorithms so they can be provided to any LADAR program without additional cost to the Navy. This can result in substantial savings over the life of a program where several software iterations can be expected.
- **STIEL**. DGTDS is the best example of a high profile quick-reaction program. In only 90 days, engineers developed a complete shoulder-launched missile detection and tracking system. No U.S. company would bid the cameras because of the high performance requirements, so cameras were purchased from France, with detector arrays provided by Israel. The optical systems were assembled at STIEL and all 6 cameras had to work in conjunction with each other to provide the desired angular coverage. The hardware and software were successfully integrated in this facility before field testing, and the results were spectacular.
- **Targeting Laboratory.** Each developer has access to their own classified machine which is then networked with all the other computers (ARPDD has 34) per project. The result is significant time savings which translates to cost reductions. The Automatic Radar Periscope Detection and Discrimination (ARPDD) program is an excellent example of how this facility is used to rush a capability to the fleet. The ARPDD program has been so successful the facility is being used to develop the actual software that will be used with the MH-60 radar.
- **Optics and Laser Research Facility.** Provides cost and time savings due to a rapid prototype fabrication capability. This includes design, subsystem fabrication, system integration, and prototype testing. For example, 16-inch range telescopes were fabricated at less than half the cost of commercial estimates, with prototypes delivered in three months. A dynamic Differential Image Motion Monitor went from concept to placed ship-board in order to measure atmospheric turbulence in 18 months.
- **Electronics Development Laboratory.** Advanced design for a wide variety of products. Technical staff is skilled at quickly resolving design issues right up front.
- **Proximity Fuze and Sensors Laboratory (PFSL).** Consists of a quick response hardware/firmware/software exploratory development section that creates prototypes of new developmental systems. The PFSL also has the most advanced simulation and analysis capability in the Navy for proximity fuze systems.

**RDT&E**

- **MSFL.** The DGTDS algorithms continue to undergo refinement for the primary counter ManPADS capability, but in this lab, DGTDS can also be tailored for other applications as well.
- **MMSSL.** The goal of the multi-mode Sensor Seeker (MMSS) program is to provide Aided Target Recognition (AiTR) to UAS operators using 3-D LADAR imaging, which extends the identification range by a factor of 5 over imaging infrared systems of equivalent apertures. Laser Radar (LADAR) can provide a variety of information for each pixel in the imagery. Currently the NAVAIR focus is on 3-D (angle/angle/range) imagery, but future systems will employ coherent detection so that Doppler can be added to the information set. Work is also being conducted to investigate 1-D (profiles) and 2-D (angle/angle) techniques for identifying targets. MMSS began fabrication of a 16-inch sensor turret, sized to be deployed aboard the Fire Scout Vertical Takeoff Unmanned Air Vehicle (VTUAV) that includes a high-resolution three-dimensional LADAR sensor. The award winning design expands the capabilities of the existing BRITE Star II sensor turret (from FLIR Systems, Portland, Oregon) that contains Mid-Wave Infrared (MWIR) and visible imaging sensors and a laser designator.
- **STIEL.** The STIEL facility was used to integrate the original DGTDS system before it was field tested. The evaluation included mapping of the MWIR camera response, and validating the interfaces between all six cameras to allow the generation of precision tracks within seconds of an event. Similarly the Long Range Infrared System (LAIRS) will use STEIL to help establish the boresighting of the various cameras and laser sources. LAIRS is a reflector telescope mated to a long-wave infra red camera and a mid-wave infra red camera that can image at the same time via beam-splitting optics.
- **Targeting Laboratory.** The focus of the work has been automatic radar classification of maritime vessels. It is being applied to various radar modalities

for vessels in port and at sea. Although automatic radar ship classification has not reached the fleet, this is the facility that will support making it happen in the very near future. In general, classifiers can be forced to make their best guess about the target, but results often yield a low confidence level. Validating this is an area where the Targeting Lab capabilities are essential.



- **Optics and Laser Research Facility.** Areas of research include laser devices, laser interaction with matter, protection against laser radiation, atmospheric propagation, and characterization, image correction, ellipsometry / polarimetry, electrically conductive optical coatings, IR sensors and image recognition. **Capabilities** include optical design and fabrication, diamond turning, optical thin films, optical characterization, ultra fast laser devices and effects, laser spectroscopy, and large optics. Surface finishing by diamond-single-point machines, reactive-sputtering coating, and precision measurement of surface finish and optical performance are all conducted in a single location.
- **Electronics Development Laboratory.** Experience covers a broad range of electronics from RF, controls, analog, interface, high speed design, electronic warfare, and embedded digital design.
- **Proximity Fuze and Sensors Laboratory (PFSL).** Capabilities include miniaturization of electronic systems, and advanced design of new sensor systems to meet evolving threats. Advanced simulation and analysis reduces the number of flight tests required.

**Size / Description / Location / Scope. Size:** 56,000 square-feet located at China Lake.

- A**nnual test events:** 100+ ManPADS launches observed with DGTDS system.
- **MMSSL. Annual Test Events:** 100+. **Year Opened:** 2009.
- **STIEL. DoD Customers:** OSD for DGTDS. **Annual Test Events:** 6. **Year Opened:** 1979.
- **Targeting Laboratory. Annual Classification Cycles**: 1,000's. **Year Opened.** 1984.
- **Optics and Laser Research Facility. Annual Test Events:** 100+. **Year Opened:** 1979.
- **Electronics Development Laboratory. Systems Supported:** 7+.
- **PFSL. Annual Analysis Cycles:** 1,000's. **Annual Test Events Supported:** 25. **Weapon Systems Supported:** 7. **Year Opened:** 1970's.

**Equipment / Instrumentation**

- **MSFL.** Currently the Multi-Sensor Fusion Lab is divided into 2 areas -- one is used for development, and the other for office and meeting spaces. The laboratory maintains 20 computer systems (Apple and PC based with LINUX systems).
- **MMSSL.** The laboratory workstations and computer systems are capable of rapidly manipulating LADAR imagery from field tests and simulations. The classified laboratory is composed of several workstations which can access an extensive (over 1000 signatures) classified database gathered from multiple field trials. Each workstation also has access to an extensive 3-D model data base, which is used to develop robust ATR algorithms**.**
- **STEIL.** The DGTDS and LAIRS hardware comprise the EO/IR systems in this facility. In the future, Infrared Search and Track (IRST) systems and eye safe laser profilers will be integrated and tested here.
- **Targeting Laboratory**. Contains over 50 separate computer systems, all performing classified processing. In addition it contains a large storage capability based on RAIDs with multi-terabyte memory. With a common central hub controlling access to all this is highly efficient system for the 20+ users.
- **Optics and Laser Research Facility**. Optical fabrication, diamond turning machine, optical coating chambers, material processing equipment, optical characterization facilities for reflection, absorption, transmission and total integrated scatter, polarimeters / ellipsometers, optical multichannel analyzers, multiple laser systems and test equipment, spectrometers, laser devices and effects, spectroscopy, large optics, multiple channel digital recording. Fiber optical splicers, and the only DoD facility that can produce Fiber Bragg Gratings.
- **Electronics Development Laboratory.** Prototype Laboratory, printed wiring board router, pick and place machine, BGA machine, and X-ray inspection.
- **PFSL.** Laser tunnels, antenna range, anechoic chamber, simulation and analysis processing labs.

**Historical Significance.** This impressive facility is named after Dr. Charles C. Lauritsen, and the facility was dedicated in June, 1976. Lauritsen earned his Ph.D. from CalTech in 1929, and rapidly developed a reputation as a brilliant researcher. In 1930 he took over direction of research efforts in the new Kellogg Radiation Laboratory; there he directed development of the first million-volt X-ray tube, an important breakthrough in radiation' therapy. During World War II, Lauritsen was perhaps the only scientist to have held a leading part in three major weapons developments: proximity fuzes, rockets, and the atomic bomb. A citation by President Truman paid tribute to his "superb guidance and inventiveness."

Dr. Charles C. Lauritsen's legacy looms large at China Lake. He first pushed for expansion of this country's World War II rocket program. When CalTech required more testing space, Lauritsen and Commander Sherman E. Burroughs led the way in selecting the very land upon which China Lake is now located. Lauritsen and his colleagues at CalTech first tackled the problem of rocket propellant; by early 1942 they were able to manufacture dry-extruded ballistite that proved suitable for their rockets. Their early successes in rocketry included development of air-launched retrorockets and barrage rockets.

**For Further Information**
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